

## ABSTRACT OF THE DISCLOSURE

Semiconductor devices comprising interconnect with improved adhesion of barrier layers to dielectric layers are formed by laser thermal annealing exposed surfaces of a dielectric layer in an atmosphere of NH<sub>3</sub> and N<sub>2</sub>, and subsequently depositing Ta to form a composite barrier layer. Embodiments include forming a dual damascene opening in an interlayer dielectric comprising F-containing silicon oxide, such as F-containing silicon oxide derived from F-TEOS, laser thermal annealing the exposed silicon oxide surface in NH<sub>3</sub> and N<sub>2</sub>, depositing Ta and then filling the opening with Cu. Laser thermal annealing in NH<sub>3</sub> and N<sub>2</sub> depletes the exposed silicon oxide surface of F while forming an N<sub>2</sub>-rich surface region.

10 Deposited Ta reacts with the N<sub>2</sub> in the N<sub>2</sub>-rich surface region to form a composite barrier layer comprising a graded layer of tantalum nitride and a layer of  $\alpha$ -Ta thereon.